The embryo-sac of Pandanus coronatus

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The Pandanaceae are generally regarded as one of the lowest families of the monocotyledons. For this reason it seemed worth while to examine the embryo-sac to determine whether it showed any evidence of primitive characters in its structure.

Material was collected in Java in 1906, and a preliminary examination showed very marked departure from the ordinary angiospermous type. An account of the results of this investigation has already been published.*

The oldest stages secured from my Javanese material showed fourteen nuclei in the embryo-sac instead of the eight nuclei found in typical angiosperms. Of the fourteen nuclei, two were at the micropylar end of the sac, the others at the chalazal end. It was impossible to tell whether this stage represented the condition at the time of fertilization, and further efforts were made to obtain material which would settle this important question.

Through the kindness of Dr. W. R. Shaw, of Manila, I have received a large amount of material, very carefully preserved, which has furnished the stages of development that were desired. Dr. Shaw writes that the species is probably *P. coronatus* Martelli —a name supposed to be synonymous with *P. tectorius* Soland. Preparations made from this material showed a number of instances in which the pollen-tube was entering the embryo-sac, and a comparison of these with the latest stages found in the material from Java showed that the latter were by no means mature.

Pressure of other work has made it impossible at this time to present a detailed account of the development of the later stages of the embryo-sac, but it is hoped later to prepare a full account of the development both of the embryo-sac and embryo. The present note is intended to give a description only of the structure of the embryo-sac at the time of fertilization.

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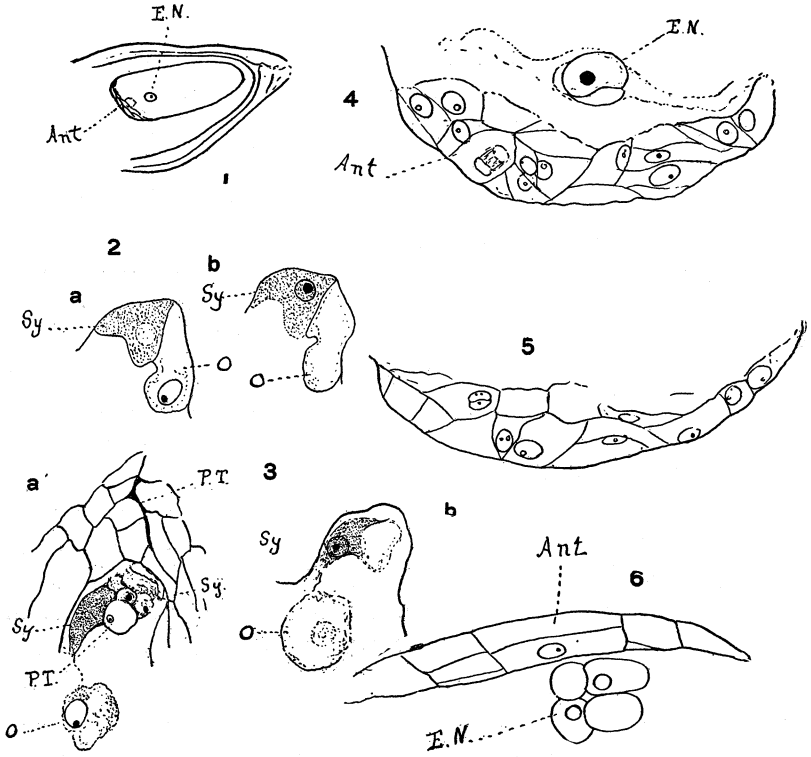
FIGURE 1 shows a section of an ovule containing the nearly mature embryo-sac. At the micropylar end is a nearly typical egg-apparatus consisting of two synergids and the elongated egg, *o*. These are shown more enlarged in FIGURE 2. At the chalazal end is a large discoidal mass of cells, the antipodal cells, the exact number of which was not ascertained, but it probably is variable. Above the antipodal tissue are two large free nuclei which probably



Explanation of figures 1-6

1. A nearly median section of an ovule of *Pandanus coronatus*, shortly before fertilization, × about 35.

2. Two sections of the egg-apparatus from the same embryo-sac, × 320; *Ant.*, antipodal cells; *E.N.*, polar nucleus; *Sy*, synergid; *o*, egg-cell.

3. *a*. Upper part of a somewhat older ovule, showing the entrance of the pollen-tube, *P. T.*, × 320. *b*. The second synergid and egg from the same.

4, 5. Two sections of the antipodal cells from the embryo-sac shown in fig. 2. There were three "polar" nuclei, *E. N.*

6. Antipodal region from an embryo-sac with six polar nuclei, of which four are shown in the figure.

represent the polar nuclei of the ordinary embryo-sac. In this specimen the pollen-tube had not yet reached the nucellus.

Several somewhat older stages were also examined, some of which showed the entrance of the pollen-tube. In FIGURE 3 the pollen-tube is seen within the embryo-sac—where it has partially destroyed one of the synergids. Two small nuclei, probably the generative nuclei, could be seen within the pollen-tube. The egg, *o*, lay some distance below the synergids, but this was probably due to displacement in mounting the sections. Two sections of the antipodal region are shown in FIGURES 4 and 5. There were three polar (?) nuclei, apparently in process of fusion.

In another specimen (FIGURE 6) there were six "polar" nuclei.

It is thus evident that at the time of fertilization, the embryo-sac of *Pandanus* has a very much larger number of cells than that of the typical angiosperms, this being shown both in the increased number of antipodal cells, and that of the "polar" nuclei.

It still remains to be seen what is the relation of the "polar" nuclei to the egg-apparatus and to the antipodals.

The embryo-sac of *Pandanus* most nearly resembles that of *Sparganium*, but in the latter the increased number of antipodal cells arises subsequently to fertilization, and there are but two polar nuclei. The structure of the embryo-sac tends to confirm the view that the families Pandanaceae and Sparganiaceae are really closely related. (See arrangement of the families of monocotyledons in Engler & Prantl, Die Natürlichen Pflanzenfamilien.)

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